CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE-247667 (INDIA)

BUILDING RESEARCH NOTE

B. R. N. 38

WOODWOOL BOARD

Wood-wool board is a wood based panel material made from chemically impregnated wood fibre and an inorganic binder such as portland cement or magnesium oxychloride. The fibre which is known as 'wood-wool' is specially made for the purpose of making board although the one which is being produced at present as a packing material can also be used. Dimensions of the wood fibre recommended are : length 20 to 50 cm, width 1 to 5 mm, thickness 0.1 to 0.2 mm. Woodwool, after impregnation with mineralizing chemical is immersed in freshly prepared binder slurry and immediately pressed in the form of board. The board achieves full strenght in two to four weeks after being cast but sufficient demoulding strength is attained within a peried of 16 to 24 hours. Ratio of binder to woodwool in the final mix and pressure during casting are controlled in such a manner that the resulting board when dry possesses known density and performance characteristics.

Woodwool boards bonded both with portland cement add magnesium oxychloride are manufactured in India. At present the only species of timber used in these boards is fir (Abies pindrow) but any other wood which gives good quality fibre and does not retard the setting and hardening of cement can be used. A large number of woods including hard woods from different parts of India have been examined at C.B.R.I. for their suitability for woodwool board. Several of them have been found commercially suitable.

Indian Standard : 3308-1981 'Woodwool Building Slabs' describes various types and performance requirements of woodwool board.

Properties

Woodwool board is characterized by low bulk density and open texture. Inter-locking of wood fibres results in the formation of numerous small voids within the board and on its surface which confer upon the material thermal insulation, sound absorption and fire-resistance properties. It is inherently resistant to decay by fungi and attack by termites.

Rough surface of the board offers excellent key for plaster The surface can be coated or painted with several types of protective and decorative coating compositions including bitumen. Natural texture of the unplastered board as such has a pleasing appearance and is liked very much by architects. It is nailable and can be cut or sawn by ordinary tools like handsaw or bandsaw but for the bulk of work special cutting devices used for masonry should be employed.

As compared to other insulating materials woodwool board has high flexural strength for structural purposes and can be considered a permanent material if kept dry. From this view point there are few materials which possess such multiple properties as woodwool board and that too at cheaper or at the most equivalent price.

Uses

The types of woodwool board are described in IS:3308—1981. Type I or light duty board is

basically meant for non-load bearing uses such as partitions, ceilings, permanent shuttering for concrete, wall lining and insulation of roofs. Type II or heavy duty board has greater bulk density and strength than type I and is intended for roof construction and external walls besides uses of type I.

Sizes

Standard size of woodwool board are : –

Length : 2000 mm
Width : 500 mm
Thickness : 12, 20, 25, 40, 50, 75 and 100 mm
But the board of following sizes is also very popular in the market and has therefore been adopted in the standard

Length : 1220 mm (4ft.)
Width : 610 mm (2ft.)
Thickness : 12, 20, 25, 40, 50, 75 and 100 mm

Boards of bigger sizes and corrugated in shape are also offered by certain manufacturers on requirement.

Performance Characteristics
Weight or Bulk Density

Boards of different thicknesses has different bulk densities, that of smaller thickness having more weight. Its bulk density ranges between 200 and 400 kg/m^3 for type I and 550 to 650 kg/m^3 for type II IS : 3308-1981 lays down maximum limit to the weight per sq. metre for various thicknesses.

Thermal Conductivity (K-Value)

High thermal insulation or low thermal conductivity (K) is important property of woodwool board. It ranges from 0.05 to 0.07 K. Cal/m hr^{0}C depending on the density of the board. Table I gives K-values of some other materials used in buildings.

Table 1:K-Values of Some Building Materials

Materials	K-value K. Cal/m h^{10}C
Brick	0.697
R. B.	0.945
R.C.C. (1 : 2 : 4)	1.360
Lime Concrete	0.628
Cement Plaster	0.628
A.C. Sheet	0.240
Mud Phuska	0.446
Cellular Concrete	0.162
Timber	0.124
Particle Board	0.085
Poly-styrene Expanded or (Thermocole)	0.027

Sound Absorption

Pore texture of its surface imparts sound absorption property to woodwool board. IS : 3308-1981 specifies minimum values of coefficient of sound absorption at different frequencies. Following values of absorption coefficient have been obtained for woodwool board by the standing wave method:

Freqency (cycles) 150 250 500 1000 2000 4000
Abs. coefficient 0.10 0.19 0.40 0.60 0.65 0.70

Conversely to the low value of thermal conductivity, higher the absorption coefficient of a material the better is its sound absorption capacity.

Better sound insulation can be achieved if woodwool board is used in plastered state or in conjunction with sheet material in single or double leaf construction. A single layer board 50 mm thick plastered on both sides can provide a sound reduction of 35 decibels which satisfies the sound insulation specifications for partitions in houses, schools etc.

Strength

There are no compressive strength requirements for woodwool board since it is a resilient material. However, under a uniform loading of 5 kg/cm^2 reduction in its thickness takes place to the extent of 5-10 per cent. Limits of deflection of the board under a definite flexural load at a fixed span have been laid down in IS : 3308-1981 for various thicknesses Its modulus of rupture (MOR) or flexural strength at break point depends mainly upon its density and ranges between 4 and 20 kg/cm^2. For type II board which is also meant for roof construction the following spans of support

have been recommended:

Thickness of the board (mm) 40 50 75 100
Centres of support (mm) 450 600 900 1200

Resistance to Water

Water vapour absorption of woodwool board when kept for a week in 80-90 percent relatve humidity is 0.05 to 0.13 percent but its water absorption in saturated condition is nearly 30 per cent. Complete immersion in water for 24 hours causes an increase of 0.15 percent in length and breadth and 1.0 percent in thickness approximately.

Resistance to Termites and Fungi

Laboratory and field experiments conducted on woodwool board samples have shown that it is not attacked by white ants and fungi.

Fire-Resistance

As compared to pure, wood, woodwool board possesses favourable characteristics in respect of noninflammability and fire resistance since every wood strand is completely coated with ceramic oxides and includes small air pockets. Although it has been classed as combustible material as per BS 476 : Part 4, it is not easily ignitible and gives little assistance to spread of flame as it achieves class I spread of BS 476 : Part 7, Depending upon the bulk density fire propogation indices of woodwool board range from 8.5 to 11.5.

Typical Applications

woodwool board has a major use in providing thermal comfort in buildings such as factories, machine shops, cold storages, air-conditioned buildings, railway coaches etc. It is mostly applied on the inner side of brick or concrete wall as a cladding material and beneath the roof. It can also be used externally with effective water proofing over it.

It has been extensively used as a sound absorbing panelling material in cinema halls, auditoria, hospitals, offices etc, to improve their acoustics. For these purposes it is unplastered or at the most it can be spray-painted for a decorative look. At places where sound damping is required as in multistorey office or residential buildings it has been used as subflooring for concrete and wooden floors.

For provision of partitions, woodwool board is used for panelling in one or two layers with or without studs in such buildings as large offices, studios etc. It can also be used as permanent shuttering for roofs, R.C.C. floors and concrete walls with the simultaneous advantage of insulation and saving the formwork. For this purpose, however, only portland cement bonded board should be used.

Low bulk-density nailability, plasterability of the surface etc. make it a suitable panel material for prefabricated light structures such as temporary shelters for industrial housing projects, various types of horti-agricultural structures, schools, health-centres, roof-top cottages, milk and telephone booths, canteens, rest-houses and structures in forward areas and high altitudes. These structures provide thermal comfort and can be dismantled, transported and re-erected a number of times.

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